ROYAL ASTRONOMICAL SOCIETY.

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J. C. ADAMS, Esq., President, in the chair.

Warren De la Rue, Esq., St. Mary's Road, Islington;
R. C. Carrington, Esq., Observatory, Durham; and
Thomas Tate, Esq., Amber Cottages, Twickenham,
were balloted for and duly elected Fellows of the Society.

The life of Professor Schumacher in the Annual Report is kept standing in type, to receive corrections and additions. Professor Struve, who furnished a principal part of the facts and dates, proposes to annex an estimate of the *influence* which the exertions and character of the deceased have had on the progress of modern astronomy. This has been delayed unavoidably from the pressure of urgent business.

Astronomische Nachrichten.

The Editor of the *Monthly Notices* suggests that it is a proper time to call attention to this invaluable publication, which has now become an astronomical necessity. We cannot contemplate the cessation of the work without dismay, and as it is not as yet known whether the support of Government will be continued, or to what extent, all well-wishers to the progress of astronomy must contribute their assistance. By such a combination, success under the new Editors, Professor Hansen and Dr. Petersen, may be ensured. From inquiries which have been made, it appears that the numbers which compose a volume can be sent free *by post* to England for 11*s.* 6*d.* The Editor proposes to open a list for subscribers at that price, requiring, however, *prepayment*, to avoid trouble and correspondence. Any Fellows of the Society, or indeed any person caring for the science, who forwards his name and address and subscription for the current volume, will receive the numbers free, and by post, as they are published.

The payments will be received by the Assistant Secretary, Mr. Williams, and the Editor will transfer the amount to Dr. Petersen.

It is possible that some gentlemen in America might wish to avail themselves of this arrangement, and it is presumed that an additional penny would pay for the sea passage of each number, if the convention between England and America includes foreign

serial publications. In this case, it would be easy to calculate the additional expense, and perhaps some friend of astronomy in the United States would charge himself with the arrangement. That the *Astronomische Nachrichten* MUST be supported, and, if possible, extended, needs no demonstration.

The *Nautical Almanac* for 1854 has recently been published. Besides the usual information, it contains ephemerides of all the newly-discovered planets for 1851, except *Egeria*, and co-ordinates of the sun for 1851, 2, 3.

Note by the Astronomer Royal.

In an oral address to the Society, "On Instruments adapted to the Measure of small Meridional Zenith Distances," delivered at the meeting of 1849, June 8 (*Monthly Notices*, vol. ix. No. 8), I alluded (page 184, last paragraph) to the opinion of Bouguer, on the impropriety of inferring the certainty of a mean result from the mere accordance of individual results. The more forcible expression, however, of this opinion, which I had in my mind, is that of Svanberg, in the account of the modern measure of an arc of meridian in Lapland; and the sentiment is so important and so well expressed that I think it desirable to place it before the Society in the very words of Svanberg:—

"L'accord d'un grand nombre d'observations ne suffit pas toujours pour en prouver la bonté, à moins qu'on ne se soit assuré auparavant, par l'examen le plus scrupuleux de l'instrument dont on s'est servi, qu'il n'y ait eu dans celui-ci aucune cause qui ait agi constamment dans le même sens pour en altérer tous les résultats."—Svanberg, *Discours Préliminaire*, p. xxvi.

Letter to the President and Council of the Royal Astronomical Society, from Mr. Dawes, with a framed Drawing of Saturn.

"Gentlemen,—I have the pleasure of presenting to the Royal Astronomical Society the accompanying picture of the planet *Saturn*, which I hope the Society will do me the favour to accept. It is specially intended to exhibit the appearance of the interior obscure zone, or ring, as discovered by me on Nov. 29th, 1850.

"As the picture refers only to the discoveries of that night, the indications I have since noticed of a division of the obscure ring into two are, of course, not introduced. Viewed at a distance of about fifteen feet, it very fairly represents the appearance of the planet in my telescope at the above-mentioned date.

"I have the honour to be, &c.

"WM. R. DAWES.

"*Wateringbury, 5th March*, 1851."

VICTORIA.

LIVERPOOL. Equatoreal. (Mr. Hartnup.)

1851.	Greenwich M.T.	R.A.	N.P.D.	Comp^{d}—Obs^{d}. R.A.	Comp^{d}—Obs^{d}. N.P.D.	Star of Comp.
	h m s	h m s	° ′ ″	s	″	
Feb. 8	7 21 54·1	1 18 5·32	80 6 30·6	−0·33	+5·1	B.A.C. 288
20	7 58 24·1	1 37 58·38	78 39 54·3	0·09	6·4	— 488
23	7 18 40·2	1 42 58·44	78 18 20·7	0·08	5·7	— —
Mar. 3	8 19 12·5	1 56 39·65	77 20 5·9	−0·07	+7·4	— —

The parallax and computed places were deduced from M. Yvon Villarceau's ephemeris, published in the *Monthly Notices*, vol. xi., No. 3.

The following are the assumed *mean* places of the stars of comparison for 1851·0, derived from the Greenwich 12-year Catalogue.

	R.A.	N.P.D.
	h m s	° ′ ″
B.A.C. 288	0 55 12·86	82 54 47·81
— 488	1 29 12·33	78 37 19·45

The following results are derived by comparison of the *Observations*, p. 54, with the ephemeris of M. Villarceau:—

	Comp^{d}—Obs^{d}. R.A.	Comp^{d}—Obs^{d}. N.P.D.
	s	″
1851, Jan. 12	−0·59	+7·4
— — 22	−0·49	+4·2
— — 23	−0·32	+7·0

EGERIA.

LIVERPOOL. Equatoreal. (Mr. Hartnup.)

1851.	Greenwich M.T.	R.A.	Log. $\frac{p}{P}$	N.P.D.	Log. $\frac{q}{P}$	Star of Comp.
	h m s	h m s		° ′ ″		
Feb. 8	8 5 8·6	2 6 27·11	+8·320	72 32 5·8	−9·7831	B.A.C. 650
	8 20 7·3	27·95	8·365	0·0	9·7876	— —
23	8 9 3·0	2 25 30·02	8·545	70 13 65·3	9·8056	— 707
	8 39 1·3	31·81	8·578	50·0	9·8217	— —
Mar. 3	9 9 51·3	2 36 57·41	8·596	68 59 30·9	9·8763	— 808
	9 24 50·3	58·42	+8·602	24·7	−9·8834	— —

The observations are corrected for refraction.

The corrections to be applied for parallax, in time and arc, are represented by p and q. P is the equatoreal horizontal parallax.

The following assumed *mean* places of the stars of comparison for 1851·0 are derived from the Greenwich 12-year Catalogue:—

	R.A.	N.P.D.
	h m s	° ′ ″
B.A.C. 650	1 59 35·50	72 40 56·86
— 707	2 9 50·73	70 47 26·13
— 808	2 30 21·83	68 41 7·80

DURHAM. Fraunhofer Equatoreal. (Mr. R. C. Carrington.)

1850.	Green. M.T. h m s	App. R.A. h m s	Log $\frac{p}{P}$	App. N.P.D ° ′ ″	Log $\frac{q}{P}$	No. of Comps. R.A.	N.P.D.	Set.
Nov. 21	7 15 48·3	1 43 30·49	−8·381	81 18 76·7	−9·866	24	8	1
	12 39 21·1	19·20	+8·425	34·3	9·869	18	6	2
27	12 21 42·9	39 9·14	+8·445	80 58 11·8	9·869	24	8	3
28	11 9 24·5	38 35·08	+8·271	54 32·0	9·859	24	8	4
Dec. 6	7 20 35·3	34 54·11	−8·126	20 80·0	9·852	8	8	5
	10 8 1·9	51·70	+8·165	44·5	9·852	20	7	6
8	11 28 21·2	34 12·52	+8·435	10 55·8	9·864	23	8	7
9	7 8 27·3	33 59·47	−8·120	80 6 57·2	9·850	23	8	8
	11 25 23·7	55·99	+8·434	7·3	9·864	15	5	9
12	8 52 54·8	33 19·03	+7·805	79 51 17·0	9·845	24	8	10
19	12 5 37·5	32 53·00	+8·551	10 57·8	9·877	15	5	11
20	8 30 3·2	32 55·77	+7·900	79 5 45·6	9·839	24	8	12
21	10 49 14·4	33 1·37	+8·462	78 59 4·4	9·860	16	8	13
23	8 40 53·2	33 15·58	+8·073	46 67·1	9·839	24	8	14
	10 37 22·7	16·36	+8·455	34·2	9·858	18	6	15
26	8 14 20·3	33 50·41	+7·961	27 47·9	9·835	24	8	16
27	9 59 32·7	34 6·43	+8·408	20 44·2	9·850	24	8	17
28	10 15 50·1	1 34 23·17	+8·451	78 13 54·1	−9·853	18	6	18

"P is the equatoreal hour parallax in seconds of arc, and p and q are the corrections in seconds of time and arc respectively."

Assumed *Apparent* Places of the Stars of Comparison.

Name and Authority.	App. R.A. h m s	App. N.P.D. ° ′ ″	Set.
Weisse, 1h, 743	1 41 19·77	81 28 9·6	1
— 801	44 45·90	81 9 8·8	2
Anonymous, 9·10 mag.	41 23·45	81 3 38·8	3
Weisse, 1h, 756	42 25·67	80 55 55·1	4
— 633	34 43·77	80 30 34·1	5
— 526	30 25·24	80 15 3·5	6
— 526	30 25·23	80 15 3·6	7
— 555 *	31 34·47	80 5 8·4	8
B.A.C. 542, Green. 12-yr Cat.	39 14·97	79 54 17·3	9
— — —	39 14·95	79 54 17·4	10
Anonymous, 9th mag.	33 43·33	79 7 32·9	11
— —	33 43·32	79 7 33·0	12
Weisse, 1h, 569	32 25·51	78 52 41·0	13
B.A.C. 490, Green. 12-yr Cat.	29 44·79	78 41 3·9	14
— 488, — —	29 12·00	78 37 23·8	15
— 488, — —	29 11·96	78 37 24·0	16
Weisse, 1h, 539	31 15·73	78 19 19·0	17
— —	1 31 15·72	78 19 19·0	18

Nov. 21. Hazy. Planet considered to be of 10th magnitude.

Nov. 27. Weisse, 1^h, 718 was missing. The place of the star used depends upon Weisse, 1^h, 756. It has a small companion n. p.

Dec. 9. Set 8. Weisse, 1^h, 555 is in error in right ascension. After comparing it with No. 526, I have diminished its right ascension by $14^s{\cdot}00$. The north polar distance agreed with the catalogue.

Dec. 12. Planet dimmed by haze, but the measures good.

Dec. 19. Moonlight nearly overpowering the planet. I could hardly afford to illuminate the wires sufficiently.

Dec. 20 and 21. The same circumstances.

Dec. 23. The second set on this night is the better one; the telescope's unsteadiness giving trouble in getting set 14.

Dec. 27. Patches of vapour, but the planet brighter and better seen than of late.

Dec. 28. High wind. Several other comparisons made and rejected on examination.

HAMBURG. Equatoreal. (M. C. Rümker.)

1851.	Hamburg M.T. h m s	Observed R.A. ° ′ ″	Observed Decl. ° ′ ″	No. Obs.
Feb. 6	8 29 46·2	31 2 14·6	+17 9 32·9	7
21	8 17 54·6	35 41 24·0	19 27 18·3	12
23	7 28 13·3	36 21 34·8	19 45 34·0	21
24	8 29 24·0	36 43 3·8	19 55 4·1	5
26	8 36 46·2	37 25 3·6	20 13 37·0	14
27	8 4 33·7	37 45 48·0	20 22 38·2	14
Mar. 2	7 54 25·6	38 50 44·9	+20 50 35·8	13

Corrected for refraction, but not for parallax.

Apparent Places of the Stars of Comparison from Lalande, Bessel, &c.

	Appar. R.A. h m s	*Appar.* Decl. ° ′ ″		*Appar.* R.A. h m s	*Appar.* Decl. ° ′ ″
Feb. 6	2 7 11·70	+17 13 11·4	Feb. 26	2 29 9·09	+19 55 24·5
21	2 22 16·60	19 11 20·7	27	2 29 9·19	20 30 25·4
23	25 6·12	19 46 37·2		32 4·25	32 34·5
24	24 48·83	19 47 40·8		32 12·27	34 39·5
26	2 28 18·79	+20 2 48·1	Mar. 2	2 36 19·17	+20 58 46·4

Elements. By M. George Rümker.

M	= 299 13 1·67	Jan. 0·0, 1851, G.M. Time
π	118 48 7·17	Mean Equinox, Jan. 0, 1851
Ω	43 17 3·51	
I	16 33 2·13	
φ	4 57 13·50	
Log a	0·4114765	
Log μ	2·9327918	

These elements are computed from the Altona observation of Nov. 13, and the Hamburgh observations of Dec. 31 and March 2.

They represent the middle observation, thus,

Calculation − Observation = −0″·10 in Longitude

— — = −0″·03 in Latitude.

METIS.

LIVERPOOL. Equatoreal. (Mr. Hartnup.)

1851.	Greenwich M.T. h m s	R.A. h m s	N.P.D. ° ′ ″	Comp^{n}—Obs^{n}. R.A. s	Comp^{n}—Obs^{n}. N.P.D. ″	Star of Comp.
Feb. 16	9 15 16·1	9 28 24·81	65 9 17·3	−3·32	+6·2	ε Leonis.
—	9 35 12·0	23·92	14·7	−3·26	+5·3	—
—	9 55 8·8	23·04	10·9	−3·21	+5·5	—

The parallax and computed places were deduced from the ephemeris published by Lieut. Stratford, R.N.

The following assumed *mean* place of the star of comparison for 1851·0 is derived from the *Greenwich Observations* for 1848:—

	R.A. h m s	N.P.D. ° ′ ″
ε Leonis	9 37 23·02	65 32 32·68

HAMBURG. Equator. and Mer. Circle. (M. C. Rümker.)

1851.	Hamburg M.T. h m s	Observed R.A. ° ′ ″	Observed Decl. ° ′ ″	No. Obs.	
Feb. 7	8 30 34·7	144 27 3·5	+24 3 54·7	16	Equatoreal.
9	7 32 13·4	143 56 10·3	15 17·7	12	—
10	8 6 11·2	40 7·8	20 52·8	17	—
11	6 57 34·0	143 25 16·1	26 4·6	8	—
13	7 21 50·3	142 53 50·5	36 18·3	8	—
14	7 19 57·2	142 38 28·7	41 4·7	11	—
17	7 20 42·4	141 52 51·5	24 54 29·5	8	—
21	9 16 18·3	140 53 54·7	25 9 25·0	7	—
23	9 11 5·6	26 29·5	15 21·5	11	—
24	9 17 45·7	140 13 13·0	18 3·3	12	—
26	10 54 29·6	139 46 52·6	22 57·0		Mer. Circle.
27	49 45·4	34 47·1	24 54·1		— —
Mar. 2	10 35 41·8	139 0 42·2	29 35·9		— —
10	9 59 27·4	137 48 42·7	32 24·9		— —
19	21 8·2	137 4 35·6	20 40·4		— —
22	9 8 57·1	136 58 43·8	25 13 37·0		— —
30	8 37 51·5	137 4 9·9	24 48 14·2		— —
31	34 6·4	6 54·2	43 35·9		— —
April 3	23 3·7	18 9·2	32 19·2		— —
7	8 8 43·5	137 39 2·6	+24 14 34·0		— —

Corrected for refraction, but not for parallax.

Mean Places, Jan. 0, 1851, of Stars Compared.

R.A. h m s	Decl. ° ′ ″	R.A. h m s	Decl. ° ′ ″
9 15 37·45	+25 5 25·3	9 22 55·48	+25 4 1·8
9 21 30·31	+25 19 45·8	9 22 2·52	+25 3 46·3

Deduced from Hamburg Meridian Observations.

MARKREE. Mer. Circle. (E. J. Cooper, Esq., and A. Graham.)

Green. M.T. 1850. d	R.A. h m s	Decl. ° ′ ″	No. Wires.	Obs^{d}—Calc^{d} R.A. s	Obs^{d}—Calc^{d} Decl. ″
Dec. 11·706193	9 58 22·72	+18 55 15·0	5	−0·03	0·0
1851.					
Jan. 8·640815	10 1 15·34	20 43 24·1	5	+0·06	0·0
17·613244	9 56 31·84	21 42 44·6	1	+0·17	+2·4
24·590220	51 10·86	22 32 10·6	4	+0·06	+3·1
31·566553	44 42·31	23 20 53·2	5	−0·28	+2·0
Feb. 7·542498	37 34·18	24 5 22·2	5	−0·17	+4·3
20·497877	24 23·53	25 6 34·0	5	−0·34	+2·1
21·494362	23 27·72	9 48·4	3	−0·06	−1·2
22·491131	22 32·24	12 55·1	5	−0·54	+0·8
26·477815	19 4·78	23 1·7	5	−0·33	+0·7
Mar. 1·467965	16 44·12	28 17·5	4	−0·12	+0·7
3·461547	15 18·17	30 43·1	5	−0·16	+1·8
6·452018	13 22·16	32 43·3	5	−0·29	+2·6
7·448885	12 47·39	32 55·1	5	−0·07	−0·2
10·439613	11 13·62	32 27·8	5	−0·16	+2·9
12·433542	10 20·77	31 6·7	5	−0·18	+1·5
18·415875	8 29·58	22 39·4	5	−0·09	+0·9
20·410167	8 8·09	25 18 28·1	5	−0·28	+2·0
29·385594	8 8·12	24 51 50·8	5	−0·25	+1·3
April 2·375025	8 57·00	36 23·9	2	−0·14	+3·2
8·360307	9 11 2·95	+24 9 22·7	5	−0·05	−2·4

Correction for parallax and compared places computed from Graham's elements, *Monthly Notices*, vol. xi. p. 36.

Jan. 8.	*Metis* much brighter than was expected.
17.	Clouds.
Feb. 21.	Extremely faint. Cloudy at last three wires.
March 1.	Clouded at fourth wire.
6.	Unsatisfactory.
7.	Very faint.
10.	Bad illumination.
April 2.	Transits very uncertain. Bisection not good.

Extract of a Letter from Professor Chevallier.

"I have lately had a clock constructed to mark right ascension in arc; the pendulum vibrating once in $\frac{2}{3}$ of a second of time, or while an arc of 10″ passes the meridian. The clock indicates at the same time sidereal *time* to the nearest minute.

"I have since heard that Sir G. Shuckburgh had a clock on this principle, which is at Greenwich; so I suppose there is no use in describing what has been already done.

"I think the quickness of beat an advantage in observing, but that is a personal matter."

Latitude of Markree Observatory by Meridian Observations.
E. J. Cooper, Esq., and Mr. Graham.

By Polaris, Above Pole.

1850.	Colat. ° ′ ″	Weight.
May 5	35 49 27·34	0·50
6	28·07	2·22
29	28·74	2·00
30	27·795	4·00
31	28·18	1·20
June 4	28·335	2·00
1851.		
Feb. 8	35 49 28·685	2·00
Mean	35 49 28·198	13·92

By Polaris, S.P.

1850.	Colat. ° ′ ″	Weight.
May 1	35 49 28·085	1·00
2	28·28	2·00
3	28·135	0·50
4	29·045	2·00
6	28·145	2·22
8	27·86	1·43
21	27·49	2·00
22	28·155	2·00
30	27·185	4·00
31	28·02	2·00
June 1	35 49 28·535	2·00
Mean	35 49 28·003	21·15

By Quick Stars.

1850.	Colat. ° ′ ″	Weight.
April 29	35 49 29·80	1·33
May 1	28·43	2·10
2	28·03	1·69
3	26·845	0·67
4	28·34	0·67
6	28·52	1·33
8	27·12	0·67
15	28·325	0·50
21	28·89	2·22
22	29·03	2·18
30	28·50	1·20
31	28·65	1·20
June 1	27·945	1·00
5	28·69	0·50
7	27·77	1·20
15	28·725	0·75
17	35 49 28·91	0·67
Mean	35 49 28·493	19·88

Mean Colatitude.

	° ′ ″	Weight.
By Quick Stars	35 49 28·493	19·88
Polaris, Above Pole	28·198	13·92
— S.P.	28·003	21·15
Mean	35 49 28·230	54·95

Latitude 54 10 31·77 North.

On the Corrections of Lindenau's Elements of the Planet Mars.
By Mr. H. Breen, of the Royal Observatory, Greenwich.

The great attention given for the last twenty years by the Astronomer Royal to planetary observations at Cambridge and Greenwich, has furnished means for determining the corrections of the elements of all the large planets with great accuracy; and with regard to the planet *Mars*, the historical interest attached to it ought, as Lindenau observes, to be a sufficient inducement to

pursue the subject. The publication of the reduction of the ancient Greenwich planetary observations by the Astronomer Royal gives, in connexion with his own series of observations, a mass of materials extending, with some interruptions, over nearly a century, and offers means for the determination of the secular variations of the elements. Mr. Breen has availed himself of all these materials as far as the year 1847. All the comparisons of the observations of *Mars* have been made with Lindenau's Tables; and through the whole series there is no other deviation from uniformity than the introduction of Mr. Airy's corrected mass of *Jupiter* in the calculations of the perturbations produced by that planet on *Mars*, for all the observations included in the planetary reductions, this correction not being included in the computations of the Berlin *Jahrbuch*, with which the places for 1833 have been compared, nor in the computations of the *Nautical Almanac* for the succeeding years. To produce strict uniformity, Mr. Breen has calculated the perturbations of *Jupiter* for each normal day from 1833 to 1847, and increased the results by $\frac{1}{50}$th part. The resulting corrections form the first table of his work.

Mr. Breen gives a brief statement of the method used by Lindenau, and of the materials employed by him in the deduction of his elements: he gives afterwards an account of his own methods. The formulæ and equations of condition used by Mr. Breen are of the same form as those used in his former papers on the corrections of the elements of the orbit of *Venus*. In the course of the work, a trifling error made in the planetary observations, by the use of wrong transit intervals for a short period, has been corrected and allowed for. The whole series of equations is divided into the following distinct groups of several years, depending on the continuity of the observations, viz. from 1751 to 1768; from 1790 to 1798; from 1820 to 1830; from 1833 to 1839; and finally from 1840 to 1847; and the corrections of the elements resulting from the solution of the equations are given separately for each group.

Determination of the Parallax of α^1 *and* α^2 *Centauri.*
By Mr. Maclear.

In this noble series, *both* stars have in almost all cases been observed with the mural circle, by reflexion and by direct vision at the *same* transit. The observations were made in the years 1842, 3, and 4, and again in 1848. The intervening years were spent on the great arc of meridian, which is now happily terminated. There are 192 double altitudes of α^1 *Centauri* and 199 of α^2 *Centauri*, and it must be borne in mind that each double altitude gives a result either free from instrumental error, or one in which the instrumental error is probably a constant. The series is divided into three groups. In the first and third groups the variable quantities of parallax and aberration run through a period or more. In the second group they run through a large part of a period.

The notation and mode of reduction is that followed by Mr.

Henderson in vol. xii. of our *Memoirs*, and the results are contained in three tables.

In Table I. we have the instrumental readings for each star observed by reflexion and directly, with the corresponding readings of the barometer and thermometers.

In Table II. each double altitude is corrected for refraction and reduced to its *mean* value for January 1 of the year of observation, and also for January 1, 1849.

Table III. contains the coefficients of parallax and of the correction to be applied to the assumed constant of aberration, as well as of the annual proper motion of each star to reduce the place to January 1, 1849. The excess of the *observed mean* altitude for 1849 above an *assumed mean* altitude is also given, and thus an equation of condition is formed for every observation of each star. We have thus six sets of equations for the two stars, each of which is solved by the method of least squares.

As a final result Mr. Maclear finds that

the parallax of α Centauri =	0″·9187	probable error =	0″·034
the constant of aberration =	20·53	probable error =	0·038

The former investigation in vol. xii. of the *Memoirs* gave 0″·9128 for the value of the parallax of α *Centauri*, and 20″·52 for the constant of aberration.

Mr. Maclear adds that his valued first assistant, Mr. Mann, has commenced a fresh series of observations of this remarkable star with the mural circle, and that he is himself attacking the parallax in right ascension with the $8\frac{1}{2}$-foot equatoreal. At the Cape and at Madras, observations for determining the orbit are making very diligently and with powerful equatoreals.

Observations of Zodiacal Light in 1851. By Mr. Lowe, Highfield House, near Nottingham.

January 22^d 6^h 30^m.

Apparent, but confused.

January 23^d 7^h.

Tolerably brilliant by fits, situated between α and β *Pegasi*; the edges too confused to enable them to be accurately marked.

January 27^d 7^h.

Brilliant by fits, the upper edge to the west of *Saturn*; the north edge passed near α *Pegasi*.

March 20^d 8^h.

Stars bright. The zodiacal light is better defined on its edges than it had been noticed here this year.

Extent of base on horizon, 23° 30′. Its southern edge cut the horizon 1° 30′ S. of W., and its northern edge 22° N. of W.

	°	′
Mean Long. of Apex	49	30
Maximum Long. of Apex.....	51	0
Minimum Long. of Apex.....	48	0

Axis, 0° 15′ N. of Pleiades, and the horizon 10° 15′ N. of W.

The north edge was brightest; it passed midway between β and γ *Arietis* (when at rest) and extended to τ *Arietis*. Its southern edge cut the star μ *Ceti*.

The phenomenon of pulsations of greater and less brilliancy was very apparent and was thought to be in periods of 30^s; when at its minimum brightness, the outline was scarcely distinguishable.

At three different periods during the observations the light widened in extent; and this widening took place each time when the light was at its maximum brightness. This was first noticed at $7^h\ 55^m$, when the north edge extended to β *Arietis*. Again, at $7^h\ 59^m$, when the north edge extended midway between β and α *Arietis*, and thirdly, at $8^h\ 3^m$, when it covered α *Arietis;* it remained in this widened state from 1^s to 3^s, returning each time to its mean place between β and γ *Arietis*. Once, when very dim, the north edge was thought to have receded to γ *Arietis* (viz. at $7^h\ 50^m$). The southern edge was not so narrowly watched, owing to a want of guide stars, so that I cannot speak positively as to whether it receded when the north edge advanced, yet the impression made at the time was, that it did not; and once (at $7^h\ 59^m$) was thought to have widened with the northern edge.

March $22^d\ 8^h$.

Pale and confused; pulsations of brightness.

The weather, especially in February and March, has been very much clouded in the evening, which was unfortunate.

Modifications of the Formulæ for computing the Latitude from extra-meridian Altitudes of the Pole Star. By Mr. John Riddle, F.R.A.S., of the Royal Nautical School, Greenwich Hospital.

"In the preface to the *Nautical Almanac*, p. xi., the following formula is given for finding the latitude from an extra-meridian altitude of *Polaris*.

$$l = a - p\cos h + \tfrac{1}{2}\sin 1''\ (p\,.\,\sin h)^2 \tan a \\ - \tfrac{1}{3}\sin^2 1''\ (p\,.\,\cos h)\ (p\,.\,\sin h)^2$$

where l = latitude
a = true altitude of star
p = apparent polar distance of star in seconds of arc
h = hour-angle of star = sid. time — R.A. of star.

"I call these corrections c_1, c_2, c_3, and I express the two smaller corrections c_2 and c_3, in *minutes* of arc, and keep p also in minutes in the formulæ for c_2 and c_3.

"Since $c_1 = p\cos h$; $(p\sin h)^2 = p^2 - c_1^2 = (p + c_1)\ (p - c_1)$; substituting this in the second equation, and reducing to seconds.

$$c_2, \text{ in seconds} = 30\sin 1'\ (p + c_1)\ (p - c_1)\tan a.$$

"In this expression p and c_1 are still expressed in minutes, and

as 30 sin 1′ hardly differs from $\frac{1}{100} - \frac{1}{8}$ 100, this quantity is easily allowed for by dividing $(p + c_1)\ (p - c_1)$ by 100 and deducting one-eighth of the quotient, calling the quantity thus found, q.

$$c_2 \text{ in seconds} = q \tan a.$$

"Three figures in the logs, exclusive of the characteristic, are sufficient.

"Lastly, if, as a matter of curiosity, the value of c_3 is desired,

$$c_3, \text{ in seconds} = 20 \sin 1' (p \sin h)^2 \sin 1' (p \cos h)$$
$$= \tfrac{2}{3}\, q\, c_1 \sin 1'$$

Or as sin 1′ is nearly ·0003, we may say,

$$c_3 = \cdot 0002\ q\ c_1,$$

In which q and c_1 may be taken roughly.

Example.

"On August 18th, 1851, in longitude 56° east, at $8^h\ 56^m\ 14^s$ mean time at the place, the altitude of the pole star, corrected for dip and refraction, was found to be 56° 28′ 33″; required the latitude: We have for the computation of the corrections,

$h = 264°\ 1'$
$a = 56\ 28$
$p = 5355'' = 89'{\cdot}3$

c_1	c_2	c_3
log p = 3·7288*	p = 89·3	q = 70
log cos h = −9·0183	c_1 = 9·3	c_1 = 9
Sum = −2·7471 = log 558″·6	Sum = 98·6	$q\,c_1$ = 630
c_1 = −9′ 18″·6	Diff. = 80·0	Const. = ·0002
	Prod. × ·01 = 78·88	Prod. = 0·13 = c_3
	$-\frac{1}{8}$ = 9·86	
	q = 69·02	log = 1·839
		tan a = 0·179
		2·018 = log 104·″2 = c_2

Alt. =	56° 28′ 33″
− c_1 =	+ 9 18·6
	56 37 51·6
+ c_2 =	+ 1 44·2
	56 39 35·8
− c_3 =	+ ·1
Latitude =	56 39 35·9 N.
=	56 39 35·5 by spherics.

* Logarithms of 5 places must be used if the result is required to decimals of a second.

On the Elements of the Binary Star γ Virginis, resulting from a Discussion of the Measures taken by Capt. W. H. Smyth, R.N. between the Years 1831 *and* 1850. By Mr. Hind.

"It is well known to the members of the Royal Astronomical Society, that amongst the stars observed for the *Bedford Cycle* by Captain Smyth, the interesting binary system *γ Virginis* occupied a prominent place. During the period included by the Bedford measures, a very critical and important part of the orbit was passed over, and great pains were bestowed upon the observations to render them as accurate as the nature of the object would permit. In 1831 the component stars were separated about $1''\frac{1}{2}$, the smaller one being situated in the north following quadrant about 12° above the parallel of declination. From this position it was watched by Captain Smyth during its passage through the same quadrant, the central distance diminishing each year until in the early part of the year 1836 the star was pronounced *single* under the best atmospheric conditions. Before the close of the spring the Bedford telescope again afforded indications of duplicity, and two nights' observations showed that the companion had just completed a fourth part of its orbit, its position being now 12° north preceding the principal star. In 1837 a further change of no less than 83° in the same direction had taken place, the *comes* lying in the angle 265° at a distance of rather more than half a second of arc from the primary. In 1847 Captain Smyth found it still on the preceding side, but at a central distance of 2″·6, and his observations early in the year 1848, showed that it had just passed the vertical point, the measures yielding an angle of 179°·5; and at the date of the last observations in 1850, the angle had further diminished to 177°·1. It thus appears that the whole series of measures taken with the Bedford telescope include a change in the *position* of the companion-star of 260°, or nearly three-fourths of a revolution, extending, as before remarked, over a very important part of the orbit. The question, therefore, naturally suggests itself, whether an investigation of the elements from this series of measures to the *exclusion of all others*, might not be one of some value, as showing, by comparison with elements founded upon the *whole of the measures of other astronomers*, including the valuable alignments of Bradley and Pond in 1718 and 1720, what kind of dependence we may place upon elements for other binary systems computed under similar circumstances, where, during the interval between the earliest and latest observations, a portion only of the ellipse has been described, which is to be traced chiefly from the measures of one observer. In the present instance the investigation promised to lead to results of especial interest; the measures of *γ Virginis*, published in the *Bedford Cycle*, were taken by one of the most experienced observers of the present day in this particular department of astronomy, were made throughout with the same instrument, and under the most favourable conditions as regards the state of the atmosphere, the powers employed, &c. With data

derived under these promising circumstances, an orbit fairly approximating to the true one (or to that which we have strongest reason to rely upon) might be expected as the result of their discussion; but I confess I had no idea that this series of measures (leaving untouched, as it does, the more distant part of the apparent ellipse when observations are made with comparative facility and proportionally greater accuracy), would produce a set of elements bearing such close resemblance to those of Sir John Herschel, which having been calculated upon the whole course of observations, on a method possessing peculiar recommendations, we may fairly presume to be the most exact system at present in the hands of astronomers. For the sake of immediate comparison the two orbits are subjoined together:

Elements of γ Virginis.

	I. From the Observations of Capt. W. H. Smyth.	II. Sir John Herschel's last Elements.
Perihelion Passage	1836·40	1836·39
Position at Perihelion	323° 50′	322° 12′
Ascending Node	20° 34′	28° 42′
Inclination to Plane of Projection	27° 23′	30° 39′
Angle between the Lines of Apsides and Nodes upon the Orbit	300° 13′	290° 30′
Excentricity	0·8804	0·8860
Period of Revolution	171 yrs. 54	183 yrs. 14

Motion in the Orbit — *retrograde.*

"In comparing these orbits, it must be borne in mind that in the present case an alteration in the position of the node of 10° has but very little influence upon the computed angles of position; and for this reason the node and the angle between the lines of nodes and apsides cannot be exactly ascertained. The agreement between the other elements is, I think, very remarkable; and as regards the period, the observations of Capt. Smyth furnish us with the time of revolution of the companion-sun round the other, differing less than *twelve* years from that which, under existing circumstances, may be regarded as the true one."

The Rev. Alfred Weld, director of the observatory at Stonyhurst College, has sent the details of his observations to determine the place of Weisse, 11h, 929. The individual results are very fairly consistent.

Mean place Jan 1, 1850.

Weisse, 11, 929 R.A. 2h 52m 36·38s 6 obs. Dec. −10° 16′ 20·8″ 5 obs.

In reference to Mr. John Riddle's solution of the problem for clearing the moon's distance (vol. xi. p. 63, &c.), Mr. Drach re-

marks that it does not materially differ from a method given by Lieut. Raper, *Practice of Navigation*, third edition, p. 286, &c., where the traverse table is used for computing the corrections.

Mr. J. W. Jeans, F.R.A.S., of Grantham, suggests that the appearances seen by Mr. Read on the 4th of last September (p. 48) probably arise from some disorder of the digestive organs. Mr. Jeans has himself seen similar appearances while observing *Venus* by daylight, and with the eye fatigued; they vanished when the eye was rested. Something similar has presented itself pretty frequently to other observers, and is generally attributed to a disordered action of the optic nerve arising from indigestion or from over-work.

Mr. Thomas Hedgcock, Master in the Royal Navy, sent a Hadley's quadrant with some modifications, which were described in an accompanying memoir. The Editor is not able to comprehend the proposed improvement, as Mr. Hedgcock has not pointed out with sufficient clearness that defect in the usual construction which he has intended to remedy. A small level is attached to the frame of the sextant to serve when the sea horizon is not distinct, but this is not a novelty.

ERRATA.

Vol. xi. p. 64, 12 lines from the top, *for* altitudes, *read* altitude.
65, 3 lines from the bottom, *for* 0·137, *read* 1·137.
—, last line, *for* 0·720, *read* 1·720.

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